

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the reasons that follow.

Claim 32 has been amended to delete redundant language. New claims 37-40 are being added. Support from new claims 37, 39 and 40 can be found in the original specification as filed, for example, in the specification on page 12, lines 14-16. New claim 38 eliminates the limitation where the preliminary combustion is “near” top dead center. No new matter has been added. Claims 2-14 and 16-40 are now pending in this application.

Rejections under 35 U.S.C. § 103

Claims 2-14, 16-19 and 27-36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,378,487 to Zukouski et al. (hereafter “Zukouski”) in view of U.S. Patent No. 6,412,276 to Salvat et al. (hereafter “Salvat”). Claims 20-26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zukouski in view of Salvat, and further in view of U.S. Patent No. 6,796,118 to Kitahara (hereafter “Kitahara”). Applicant respectfully traverses these rejections for at least the following reasons.

Independent claim 2, with corresponding features in independent claims 30 and 32, recites “the controller is configured . . . to perform a main fuel injection to start the main combustion after the preliminary combustion is finished,” and “wherein the controller is configured to perform the preliminary fuel injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center.” Thus, in claim 2, preliminary fuel injection is performed at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center, while the main fuel injection is performed to start the main combustion after the preliminary combustion is finished. The references applied in the rejections fail to disclose at least this feature of claim 2, and in particular Zukouski does not disclose performing a preliminary fuel injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center, and

additionally performing main fuel injection to start the main combustion after the preliminary combustion is finished.

Zukouski discloses a technique of performing a pre-pilot injection 225 before a pilot injection 215 and a main injection 205 in a diesel engine as shown in FIG. 2A, which illustrates a plot 200 describing the rate of injection (ROI) as a function of the crank angle (col. 4, lines 48-58). Zukouski further discloses in FIG. 3A that the heat releasing process of the preliminary combustion may start before TDC (210) and end after TDC, as shown by a heat release rate curve 420.

Zukouski, however, does not disclose as recited in claim 2, with corresponding features in independent claims 30 and 32, a preliminary fuel injection performed at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center, while the main fuel injection is performed to start the main combustion after the preliminary combustion is finished. Rather, in Zukouski, the main combustion is continuous with the preliminary combustion starting before TDC and ending after TDC, as clearly shown by the heat release rate curve 420 in FIG. 3A

Moreover, in Zukouski, the main injection 205 is injected at about TDC (210) (col. 6, lines 50-51). That is, the main injection 205 is injected in the midst of the preliminary combustion starting before TDC and ending after TDC. Accordingly, the fuel of the main injection in Zukouski is burned in diffusive combustion. By contrast, in each of the independent claims 2, 30 and 32, the main injection is injected to start the main combustion after the preliminary combustion is finished such that a premixed combustion process is predominant in the main combustion. Zukouski fails to disclose this feature as recited in independent claims 2, 30 and 32.

Salvat and Kitahara were cited for other features of the claims, but fail to cure the deficiencies of Zukouski.

Moreover, Salvat, which was cited for disclosing a particulate filter for an internal combustion engine, teaches prolonging combustion as long as possible in order to obtain

higher gas temperature in the combustion chamber so as to trigger combustion of soot in the particulate filter 4 (See col. 2, lines 61-67), and discloses producing a continuous combustion. Therefore, even if Zukouski and Salvat were combined, the combination would not suggest all of the features of claims 2, 30 and 32.

The dependent claims are patentable for at least the same reasons as their respective independent claims, as well as for further patentable features recited therein.

For example, with respect to claim 3, the Patent Office cites to Salvat at col. 2, line 61 to col. 3, line 20. Salvat, however, merely discloses continuous combustion, and fails to disclose the split combustion as recited in claim 3. With respect to claim 4, the Patent Office cites to Salvat at col. 2, lines 47-67. The Salvat system, however, in contrast to claim 4, does not use the condition of the exhaust purifier 4 to trigger the changeover of the combustion control mode from the mode of FIG. 2 to the mode of FIG. 3.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing or a credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith,

Applicant hereby petitions for such extension under 37 C.F.R. § 1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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